Philips Medical Systems

Amplimat acceptance manual

Level 0 Documentation

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SERVICE MANUAL –UNIT
742

Amplimat acceptance

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List of pages and drawings (LOPAD)

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This manual can be used with generators

- **SCP 50/80/100kW**
- **Optimus RAD 50/65/80kW**
- **Optimus R/F 50/65/80kW**
- **Optimus C 50/65/80kW**
- **Velara**

Tools required:
- **oscilloscope**
- **digital volt meter**
- **15-pin Sub-D adapter or D-connector measuring board 4522 104 66112**

Contents

DRAWINGS

1. INTRODUCTION AND TECHNICAL DATA

1.1. SENSITIVITY OF AMPLIMAT CHAMBER FIELDS

Due to anatomical reasons the chambers are designed to have more than one measuring field.

Increases in the collimated area of an exposure, result in an increase of scattered radiation.

As soon as the lateral fields are selected and are participating in the exposure control they detect more scattered radiation on top of the direct radiation compared to the center field.

If all fields had the same sensitivity there would be an earlier exposure termination as the density voltage (lateral fields selected) is achieved earlier, but the film would not get its required dose for the same density and resolution as if it was taken with the center field.

Therefore the weighting of the lateral fields is higher compared to the center field, it depends on the application in which they are typically utilized (see tables at the end of the document) and the geometrical design.

>> The individual fields of an Amplimat chamber do not have the same sensitivity.

The center field of any kind of chamber type has its certain basic sensitivity (dose [µGy] / density voltage [V]), which is the base for 100% or a factor of 1.

1.2. PHYSICAL SIDE EFFECTS

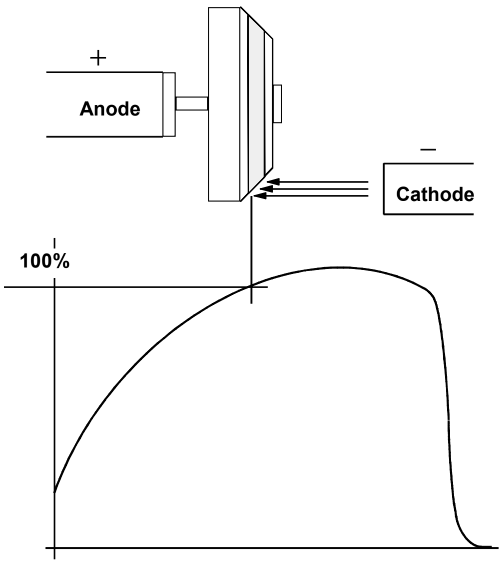
The Heel Effect results in an inhomogeneous dose across the image area parallel to the rotation axis of the anode.

Simplified one can say that the dose decreases from the center radiation beam axis (90° with respect to the rotation axis) heading for the anode, it slightly increases from the center beam point in the direction of the cathode.
The values given in the "anode position factor" tables are the reciprocal multipliers of the typical dose values compared to the basic dose value of **1** measured at the center field.

The dose differences caused by the Heel Effect are also anode angle dependent.

The dose values to the sides of central axis (left and right) are just focus distance dependent and are symmetrical.

With a 25mm aluminum filter (chapter 2.4 for the field sensitivity measurements), one does not get a value > 1 which is the base value of the central beam at the center field. The values shown in the graph are without filter.



This graph is just a simplified example giving no details about

- anode angle
- angle with respect to the central beam of the measured dose
- source image distance
- kV value

2. FUNCTIONAL TESTS OF AMPLIMAT CHAMBERS AND GENERATOR AEC FUNCTIONS

Terms:

detector = measuring field

receptor = cassette / film / Image Intensifier

absorber = phantom, patient equivalent

- The given tolerances in this manual **exclude the deviation** of test equipment on site.
- The nominal density D_N of a film-screen combination used for the test has been adjusted to any O.D. (optical density) factor according to the customers taste
- Use water as phantom (phantom thickness = water height = kV dependent)
- The film processing is considered to be ok.
- The generator 'built-in mAs read-back circuit' can be used instead of or additionally to an external, non-invasive mAs measurement.

2.1. EXPOSURE TERMINATION WITH TEST RAMP, NO RADIATION (SCP ONLY)

Purpose:

Verify the functions of density reference, signal input and switch-off circuit with a built-in 'Diagnosis ramp' with or without radiation.

Procedure for SCP:

- Set SCP to **PROG** mode with jumper **EZ119 W3** in upper position and reset the generator.
- Set **S1** on PCB chamber selector **EZ 169** to the upper **TEST** position.
- Connect a DVM at PCB signal processing **EZ 164 X21 VDENSITY** and **X23 0VXG.**
- The density step indicated at the control desk can be at any value, but the kV characteristic must be curve 4 (linear, service mode 2.5).
- The DVM indicates a certain voltage level.
- Set generator to mode 'Exposure without radiation' (recommended):
  EZ175 S1 to upper position; **EZ112 S4** to upper position; **EZ126 W6** into position **EXSIM**;
  Set service mode **7.2 to '1' at kV post indication** (automatically ‘0’ after reset or off-on).
- Set any kV value and switch an exposure, record the density voltage and the exposure time in the table (multiple exposures should always lead to identical exposure times).
- Select the small and corpulent patient size correction keys, record the density voltage and the exposure time in the table.
- **Result:** The division factor (just the numerical values density voltage by the exposure time value) should be within 10% deviation.
- This test confirms that the simulation ramp and the signal processing work well.
- Set **S1** on PCB chamber selector **EZ 169** back to the lower **NORM** position.

	no correction	small	corpulent
a = density voltage EZ164 X21 [mV]			
b = exposure time [ms]			
division factor a / b =			

Procedure for Optimus RAD + R/F + C and Velara:

Optimus RAD + R/F + C and Velara generators do not yet provide a built-in test ramp. Optimus and Velara generators will not get an exposure simulation function without radiation.
Signal processing will later be checked under radiation condition.

2.2. DARK CURRENT CHECK OF IONIZATION CHAMBER

Purpose:

There should be no drift of the chamber signal once it is in a state ready to receive dose.
Additionally one also checks the proper insulation of the chamber (path of the ground connection) and the insulation of the sensor signal against electrical ground.
The drift of the detector/chamber signal (dark current) can be checked with a DVM, but insulation problems (ground connections to the chamber body) can only be detected with an oscilloscope. The measuring points are the same as for the DVM.

Procedure SCP:

- Select auxiliaries with an ionization chamber.
- The test switch **EZ169 S1** must be in the lower **NORM** position.
- Connect DVM or oscilloscope at **X22 SIGNCHPM** of PCB chamber selector **EZ169** and **0VXG.**
- Press **S2** on this board.

Procedure Optimus RAD + R/F + C:

15-pin Sub-D measuring chamber connection

1	PO_400V	9	
2		10	
3	field right	11	field left
4	**REL**	12	field center
5	**PO_15**/40V	**13**	**GND**
6	NG_15V	14	
7	**signal**	15	
8	RF_0V		

- Select auxiliaries with an ionization chamber.
- Connect a DVM or oscilloscope at **X4 DS_MC_SG** of PCB basic interface **EZ150** and **X5 GND** or at the Sub-D connector input with an adapter at **pin 7 = signal** and **pin 13 = GND**.
- Since the Optimus does not provide a test switch. the REL signal of the selected chamber has to be activated manually:
  Place a link between **pin 4** (+15V supply) and **pin 5** (REL signal) of the selected chamber.
  Activating the REL signal opens the short link of the integration capacitor of the chamber amplifier.
  [**Attention!** In case the chamber is of an old type with a +40V chamber amplifier supply, use the +15V]
  [supply at the back panel of the PCB EZ102 X2:DBZ22).]
  The link can also be established when the PCB EZ150 is on extender boards or directly at the back panel, signals see drawing Basic interface Z1-6.

Procedure Velara:

- Select auxiliaries with an ionization chamber.
- Connect a DVM or oscilloscope at the Sub-D connector input with an adapter at **pin 7 = signal** and **pin 13 = GND**.
- Since the Optimus does not provide a test switch, the REL signal of the selected chamber has to be activated manually:
  Make a link between **pin 4** (+15V supply) and **pin 5** (REL signal) of the selected chamber.
  Activating the REL signal opens the short link of the integration capacitor of the chamber amplifier.
  [**Attention!** In case the chamber is of an old type with a +40V chamber amplifier supply,]
  [the test **cannot** be carried out, there is no access to a +15V supply voltage.]

Result:

The chamber offset < 10mV at the beginning of the test can rise by max. +4mV/sec or –8mV/sec depending on the temperature and the climatic conditions (20-25°C, 45-75% relative humidity).
At 40°C and 85% relative humidity it might rise up to ±40mV/sec.

Nominal offset			Drift in 30 sec	
chamber1:	....	mV	....	mV
chamber2:	....	mV	....	mV
chamber3:	....	mV	....	mV

Any kind of modulation on the chamber signal can indicate a ground connection to the chamber body, check for insulation problems.
The ground line coming from the generator (SCP pin N or Optimus pin 13 to chamber PHX109) is connected to PHX110 and then to the chamber cable screen, the cable screen must not have a ground connection at the generator side.

2.3. LOCATION OF MEASURING FIELDS

Purpose:

Verify that all detectors are selectable according to their corresponding desk indication.
At systems with automatic collimation insert a big cassette to get access to all chamber fields.
Please keep in mind that only the center field is displayed at the control desk for some chamber types (e.g. Scopomat).

Procedure:

- Set 80kV, large focal spot.
- Open collimator to max. size (some systems need a big cassette to get it opened).
- Use a 25 mm Al filter at the collimator.
- Cover non-selected fields with a lead strip [size 1..2mm, 80x300mm] according to test procedures of Manual Subsystem Measuring Chambers 8mm PEI 9803 509 .0.02, Manual Order No. 4512 988 02921.
- Expose all detectors sequentially.

Result:

Exposure time with covered fields should be noticeably longer.

2.4. CHAMBER FIELDS SENSITIVITY TEST

Prerequisites / Preconditions:

The central X-ray beam is perfectly aligned (90°) with the grid and the chamber (parallel to each other).

The SID is set to the basic focus value of the grid.

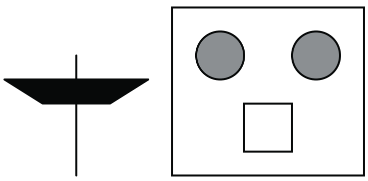
The measuring sensor is positioned in front and in the center of the center field.
It remains there during the entire process as reference.

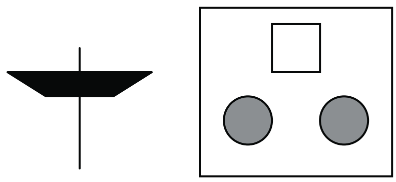
The collimator shutters must be opened to a size that all fields are fully covered by light and X-ray.
The selection of the chamber fields takes place in a different way.
Bucky: Insert the biggest cassette; all fields can individually be selected from the control panel.
Scopomat: Fields cannot be selected from a control panel; they are activated according to the selected cassette size.

A 25mm Aluminum filter must be positioned at the collimator beam output.

Select kV fixed current AEC technique to achieve exposure times of 50...100ms depending on the programmed or selected image speed type (film-screen-combination, imaging plate, digital detector), see table:

kV	**77**			
cassette / detector speed	100	200	400	800
mA	**160**	**80**	**40**	**20**





Anode position factors (Heel Effect) 13° anode angle						
Anode facing the lateral fields				**Cathode facing the lateral fields**		
SID [cm]	center	left + right	additional	SID [cm]	center	left + right
80	1	1.25	1.10			
110	1	1.15		110	1	1.09
150/200	1	1.03		150/200	1	1.02

Anode position factors (Heel Effect) 15° anode angle						
Anode facing the lateral fields				**Cathode facing the lateral fields**		
SID [cm]	center	left + right	additional	SID [cm]	center	left + right
80	1	1.19	1.08			
110	1	1.12		110	1	1.12
150/200	1	1.04		150/200	1	1.04

<u>Calculation table for measuring procedures</u>
(with an example for a Bucky chamber type 9890 000 0161x, SRO 33/100 with a 13° anode angle at 110cm SID, anode facing the **lateral** fields):

Chamber type and fields		**chamber 12NC:** ***9890 000 0161x***						
Bucky Children's Chest Sco42/52	**Scopo 63/73 71/74**	**mAs measured**	**weighting factor**	**anode position factor**	**nominal mAs (calculated)**	**deviation mAs**	**% deviation**	**max. % deviation**
center		**1.97**	**1**	**1**	**---**	**---**	**---**	**---**
left	additional	2.72	1.17	1.15	2.65	0.07	2.6	10
right	lateral	2.68	1.15	1.15	2.60	0.08	3.1	10

chamber field	mAs measured	weighting factor	anode position factor	nominal mAs	deviation [mAs]	**% deviation**
center	**<u>1.97</u>**	**1**	**1**	**1.97**	**---**	**---**
left	**<u>2.72</u>**	**<u>1.17</u>**	**<u>1.15</u>**	2.65	0.07	**<u>2.6</u>**
right	2.68	1.15	1.15	2.60	0.08	3.1

Formula:

$$\mathbf{\frac{M - (C \times W \times A)}{(C \times W \times A)} \times 100\% = \%\ deviation} \qquad \frac{\underline{2.72}\ \text{mAs} - (\underline{1.97}\ \text{mAs} \times \underline{1.17} \times \underline{1.15})}{(\underline{1.97}\ \text{mAs} \times \underline{1.17} \times \underline{1.15})} \times 100\% = \underline{2.6\%}$$

C	=	center field mAs = reference mAs and dose value	
M	=	measured mAs of field x	
W	=	weighting factor of field x	(chamber type specific, see tables)
A	=	anode position factor for field x	(chamber type + SID specific, see tables)

Measuring chamber acceptance test sheets are at the end of this document
or
with the service PC as EXCEL spreadsheet.

2.5. AEC RESPONSE TIME

Purpose:

Verify that AEC meets the minimum response time that guarantees reproducible exposures especially in ranges with low dose requirements. Factors like cable length/capacity, kW from selected focal spot, control circuits, system absorption and the density reference = receptor speed must be taken into account.

Procedure:

- Set 60 kV to start with.
- Set falling load technique > 30kW, large focal spot preferred to get max. load.
- Open collimator to max. size (some systems need a big cassette to get it opened)
- Select **lateral** fields only.
- No absorption in beam.
- Time measurement: non-invasive method in the beam.
- Switch 2 or more exposures in a row with the same kV value and calculate the mean value.
- Increase the high tension in 10kV steps up to 100kV or more until the min. exposure time is achieved (within a deviation of < 20%).

kV	60	70	80	90	100	110	120
tR stable < 20% deviation [ms]							

Limits:

tR = < 1.2 * tRS [ms]

tRS **SCP** = 1ms (post indication ± 5% ± 1ms)
Optimus = 1ms (post indication ± 3% ± 0.5ms)
Velara = 1ms (post indication ± 3% ± 0.5ms)

tR = max Response time

tRS = specified Response time from Supplier

Remark:

Exposure times that have been monitored with an oscilloscope at the kV waveforms (high tension actual value, non-invasive) should be measured between 75% ± 7.5% of kVp at the high voltage rising edge and 75% ± 7.5% of kVp at the high voltage falling edge.

3. COMPLIANCE TESTS

IEC 60601-2-7 chapter 50.102.2 b for AEC exposures

3.1. PREREQUISITES AND EXPOSURE TEST SERIES:

- Use a 18x24cm / 7x9.5 inch cassette
- Use only this cassette for the entire test procedure
- Select only the center measuring field
- Use only water as phantom (heights of 10/15/20cm or 4/6/8 inches required), the water must cover the entire cassette area to achieve a homogeneous density,
  the water phantom should be positioned as close as possible to the cassette
- Set the generator to single step kV values to be able to set the kV values given in the table
- Set an SID of 100cm / 40 inches with an appropriate grid mounted

Test series 1)

	water phantom height					
	10cm / 4 inch		15cm / 6 inch		20cm / 8 inch	
U[kV]	O.D.	t[ms]	O.D.	t[ms]	O.D.	t[ms]
60						
80						
100						
120						

Test series 2)

80kV		
15cm / 6 inch water phantom		
exp.	O.D.	t[ms]
1		
2		
3		
4		
5		

same exposure

3.2. EVALUATION OF MEASURING DATA

3.2.1. kV compensation (IEC 60601-2-7 chapter 50.102.2 b-1)

Purpose: Verify that AEC compensates changes of kV

Procedure:
- Calculate the mean value of the O.D. values of the **column 15cm / 6 inches** water phantom of exposure **test series 1)**

  O.D. mean value = …………..
- Check O.D. deviations with respect to the mean value
- Check O.D. deviations of adjoining density values

Limits:
max. Δ = 0.15 O.D. of O.D. mean value
and
max. Δ = 0.15 O.D. of adjoining values

Result:

	60kV	80kV	100kV	120kV
O.D. deviations				

condition Δ ≤ 0.15 O.D. complies	
yes	no

	60 ↔ 80 kV	80 ↔ 100 kV	100 ↔ 120 kV
O.D. deviation of adjoining values			

condition Δ ≤ 0.15 O.D. complies	
yes	no

3.2.2. Thickness compensation (IEC 60601-2-7 chapter 50.102.2 b-2)

Purpose:

Verify that AEC compensates changes of the thickness of an irradiated object (phantom / patient).

Procedure:
- Compare the four pairs of exposures of **test series 1)** made at the same kV value but with different water phantom heights.

Limit:
max. Δ = 0.20 O.D. deviation of each pair of exposures

Result:

	60kV	80kV	100kV	120kV
O.D. pair deviations				

condition Δ ≤ 0.20 O.D. complies	
yes	no

3.2.3. kV and thickness compensation (IEC 60601-2-7 chapter 50.102.2 b-3)

Purpose: Verify that AEC compensates changes of kV and the thickness of an irradiated object (phantom / patient)

Procedure:
- Calculate the mean value of all eight O.D. values of the exposures taken in **test series 1)**.

  O.D. mean value = …………..
- The deviation of the individual O.D. values with respect to the mean value must not exceed the limit value.

Limit:
max. Δ = 0.20 O.D. deviation of the individual with respect to the O.D. mean value

Result:

	Water phantom height		
	10cm	15cm	20cm
U[kV]	Δ O.D.	Δ O.D.	Δ O.D.
60			
80			
100			
120			

Condition Δ ≤ 0.20 O.D. complies	
yes	no

3.2.4. AEC reproducibility (IEC 60601-2-7 chapter 50.102.2 b-4)

Purpose:
Verify that AEC guarantees reproducible exposures.
The reproducibility must be within the coefficient of variation.

Procedure:
- Calculate the mean value of the O.D. values taken in the exposure **test series 2)**.

  O.D. mean value = ……………..
- The deviation of the individual O.D. values with respect to the mean value must not exceed the limit value.

Limit:
max. Δ = 0.10 O.D. deviation of the individual with respect to the O.D. mean value

Result:

	1	2	3	4	5
O.D. deviations					

condition Δ ≤ 0.10 O.D. complies	
yes	no

4. SAFETY FUNCTIONS AEC

Purpose:
Verify the functionality of the backup timer and mAs limiter

Test conditions:

Remove existing chamber signal lines

SCP	EZX 1001…1006
Optimus	EZX 21 / 22 / 31 / 32 / 41
Velara	EZX 11 / 12 / 13 / 14

to simulate a total malfunction.

Keep the collimator closed for all following exposures to avoid unnecessary radiation.

Procedure:
Release exposures with the following conditions and record the results in the brackets [**x**].

4.1. BACKUP TIMER AND SAFETY CUT-OUT SCP

SCP release 9.x and 10.x generators should not have the EEDL (exposure entrance dose limitation) on.
All SCP releases:
Change the technique so that the generator has no APR key selected, then all optional techniques programmed at an APR are automatically off.

a) Backup timer:
- Set 60-70kV, select any focal spot
- Select kV-mA technique, 10 mA

Limit: 4000 msec. (Philips spec. limit)

Results:

backup time 4000 msec. reached	YES [ ]	NO [ ]
underexposure signal blinking 'X'	YES [ ]	NO [ ]
manual reset necessary	YES [ ]	NO [ ]

b) Safety cut-out:
- Set 60-70kV, select **large** focal spot **only**
- Select kV falling load technique

Limit:
600 mAs +0/-50 mAs (max limit 600mAs IEC 60601-2-7 chapter 29.1.104 e)

Results:

HHS limit of 600 mAs	YES [ ]	NO [ ]
underexposure signal blinking 'X'	YES [ ]	NO [ ]
manual reset necessary	YES [ ]	NO [ ]

Switch off and re-establish the Amplimat cable connections.

4.2. BACKUP TIMER AND SAFETY CUT-OUT OPTIMUS

a) Backup timer:

- Set 60-70kV, select any focal spot
- Program an APR with kV-mA technique RAECF,
  Select “No AEC technique = RUIT” and enter data 1 mAs – 1000ms – 1mA
- Select the less sensitive film-screen-combination
- The APR label must display the overriding “*” at the end of the APR label (e.g. by pushing a focus key)

Limit: 4000 msec. (Philips spec. limit)

Results:

backup time 4000 msec. reached	YES [ ]	NO [ ]
underexposure indication blinking 'X'	YES [ ]	NO [ ]
manual reset necessary	YES [ ]	NO [ ]

b) Safety cut-out:

- Set 60-70kV, select **large** focal spot **only**
- Select kV falling load technique
- Select the less sensitive film-screen-combination
- Set the + dose correction value to its maximum step
- The APR label must display the overriding “*” at the end of the APR label (e.g. by pushing a focus key)

Limit:
580 mAs (default setting of Optimus) +0/-20 mAs (max limit 600mAs IEC 60601-2-7 chapter 29.1.104 e)

Results:

HHS limit of 600 mAs	YES [ ]	NO [ ]
underexposure indication blinking 'X'	YES [ ]	NO [ ]
manual reset necessary	YES [ ]	NO [ ]

Explanations for premature exposure terminations and “AEC fault exposure detection strategy” can be found in chapter FAULT FINDING of the generator binder.

Switch off and re-establish the Amplimat cable connections.

4.3. BACKUP TIMER AND SAFETY CUT-OUT VELARA

a) Backup timer:
- Set 60-70kV, select any focal spot
- Select kV-mA technique with the lowest mA possible, Automatic = yes
- Select the less sensitive film-screen-combination
- The hand symbol indicating manual mode or overriding must be displayed

Limit: 4000 msec. (Philips spec. limit)

There must be an attenuating object in front of the chamber field(s) depending on the selected kV and the selected film-screen combination.
With nothing in the beam the termination might be normal and too early, too much attenuation might activate the incorrect exposure supervision and the exposure will be interrupted.

Results:

backup time 4000 msec. reached	YES [ ]	NO [ ]
underexposure message on	YES [ ]	NO [ ]
manual reset necessary (message)	YES [ ]	NO [ ]

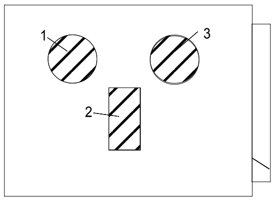
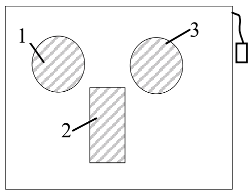
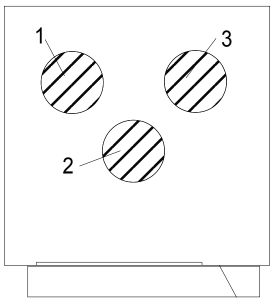
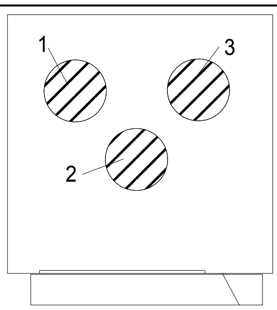
b) Safety cut-out:
- Set 60-70kV, select **large** focal spot **only**
- Select kV falling load technique
- Select the less sensitive film-screen-combination
- Set the + dose correction value to its maximum step
- The hand symbol indicating manual mode or overriding must be displayed

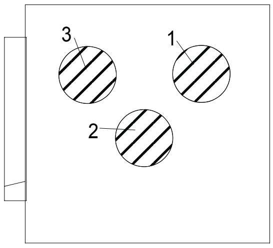
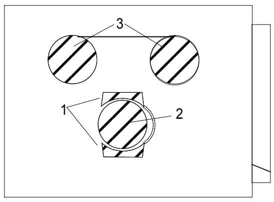
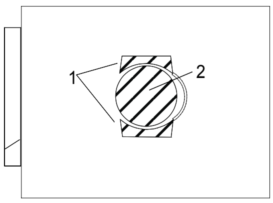
Limit:
580 mAs (default setting of Velara) +0/-20 mAs (max limit 600mAs IEC 60601-2-7 chapter 29.1.104 e)

Results:

HHS limit of 600 mAs	YES [ ]	NO [ ]
underexposure message on	YES [ ]	NO [ ]
manual reset necessary (message)	YES [ ]	NO [ ]

5. TABLE OF REQUIRED DOSE AND SENSITIVITY OF AMPLIMAT CHAMBERS

Chamber	**PEI No.** **Code No.**	**Diagram**	**Fields**	**Required Dose of Chamber µGy/V** Tol. ± 15 %	**Relative required Dose of fields**, center field C=1.00 Tol. ± 10 %	**Relative sensitivity of fields**, center field C=1.00 Tol. ± 10 %
Bucky	9803 509 1000x 4512 102 1948x		LCR LCR rearside Left (1) Center (2) Right (3)	5.86 6.91	1.08 1.17 1.00 1.15	0.92 0.85 1.00 0.87
	9890 000 0161x 4512 104 3500x		LCR LCR rearside Left (1) Center (2) Right (3)	5.24 6.18	1.08 1.17 1.00 1.15	0.92 0.85 1.00 0.87
Digital Bucky 11 mm	9890 000 0267x		LCR LCR rearside Left (1) Center (2) Right (3)	2.60 3.66	1.00 1.00 1.00 1.00	1.00 1.00 1.00 1.00
Children's Bucky	9803 509 1010x 4512 102 8030x		LC LC rearside Lateral (1) Center (2)	5.42 6.39	1.05 1.18 1.00	0.95 0.85 1.00
	9890 000 0162x 4512 104 3501x		LC LC rearside Lateral (1) Center (2)	4.81 5.67	1.05 1.18 1.00	0.95 0.85 1.00
Chest	9803 509 5000x 4512 102 1972x		LCR LCR rearside Left (1) Center (2) Right (3)	5.86 6.91	1.16 1.31 1.00 1.30	0.86 0.76 1.00 0.77
	9890 000 0166x 4512 104 3505x		LCR LCR rearside Left (1) Center (2) Right (3)	5.24 6.18	1.16 1.31 1.00 1.30	0.86 0.76 1.00 0.77

Chamber	**PEI No.** **Code No.**	**Diagram**	**Fields**	**Required Dose of Chamber µGy/V** Tol. ± 15 %	**Relative required Dose of fields**, center field C=1.00 Tol. ± 10 %	**Relative sensitivity of fields**, center field C=1.00 Tol. ± 10 %
Scopomat 42/52	9803 509 3020x 4512 102 1942x		LCR LCR rearside Left (1) Center (2) Right (3)	5.68 6.91	1.08 1.21 1.00 1.26	0.93 0.83 1.00 0.79
	9890 000 0165x 4512 104 3504x		LCR LCR rearside Left (1) Center (2) Right (3)	5.07 5.98	1.08 1.21 1.00 1.26	0.93 0.83 1.00 0.79
Scopomat 63/73	9803 509 3000x 4512 102 0410x		ACL ACL rearside Additional (1) Center (2) Lateral (3)	5.33 6.29	1.05 1.07 1.00 1.13	0.95 0.93 1.00 0.88
	9890 000 0163x 4512 104 3502x		ACL ACL rearside Additional (1) Center (2) Lateral (3)	4.81 5.68	1.05 1.07 1.00 1.13	0.95 0.93 1.00 0.88
Scopomat 71/74	9803 509 3010x 4512 102 0444x		AC AC rearside Additional (1) Center (2)	5.16 6.08	1.01 1.06 1.00	0.99 0.94 1.00
	9890 000 0164x 4512 104 3503x		AC AC rearside Additional (1) Center (2)	4.63 5.46	1.01 1.06 1.00	0.99 0.94 1.00
Junior Diagnost Extremities	9803 509 5120x 4512 104 4762x		Reduced	1.14	33.80	

Remarks:

1. Formula

$$\mathrm{Rel.}Dose_{Field\_l/R} = \frac{Dose_{Field\_L/R} * 100\%}{Dose_{Field\_C}}$$

$$\mathrm{Rel.}Sensitivity = \frac{Dose_{Field\_C}}{Dose_{Field\_L/R} * 100\%}$$

   Relative required dose of Field Left or Right with $Dose_{Field\_C}$ = 100 %,
2. The values of the “required dose” are made under test conditions at the chamber factory.
3. The reduced sensitivity of the lateral fields due to the following points:
   - The lateral fields are used with large objects. Large objects increase the scatter radiation. Therefore the chamber sensitivity has to be adapted (e.g. format contacts and the programmable density correction can be also used to stabilize the film density).
   - The preferred combinations of fields are 1., 1. + 2. or 1. +2. + 3.. The sensitivity of the single fields is calculated for constant film density in this combination.
   - The inhomogeneity of the patient and the region of interest needs an adaptation of the sensitivity (e.g. chest, high difference of density).

Chamber type and fields		chamber 12NC:						
Bucky Children's Chest Sco42/52	Scopo 63/73 71/74	mAs measured	weighting factor	anode position factor	nominal mAs (calculated)	deviation mAs	% deviation	max. % deviation
center			1	1	---	---	---	---
left	additional							
right	lateral							

M - (C x W x A)
----------------------- x 100% = % deviation
(C x W x A)

C = center field mAs = reference mAs and dose value
M = measured mAs of field x
W = weighting factor of field x (chamber type specific, see tables)
A = anode position factor for field x (chamber type + SID specific, see tables)

field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)

field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)

Chamber type and fields		chamber 12NC:						
Bucky Childrns. Chest Sco42/52	Scopo 63/73 71/74	mAs measured	weigh-ting factor	anode position factor	nominal mAs (calcu-lated)	deviation mAs	% deviation	max % deviation
center			1	1	---	---	---	---
left	additional							
right	lateral							

field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)

field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)

Chamber type and fields		chamber 12NC:						
Bucky Childrns. Chest Sco42/52	**Scopo 63/73 71/74**	**mAs measured**	**weigh-ting factor**	**anode position factor**	**nominal mAs (calcu-lated)**	**deviation mAs**	**% deviation**	**max % deviation**
center			**1**	**1**	**---**	**---**	**---**	**---**
left	additional							
right	lateral							

M - (C x W x A)
------------------------ x 100% = % deviation
(C x W x A)

C = center field mAs = reference mAs and dose value
M = measured mAs of field x
W = weighting factor of field x (chamber type specific, see tables)
A = anode position factor for field x (chamber type + SID specific, see tables)

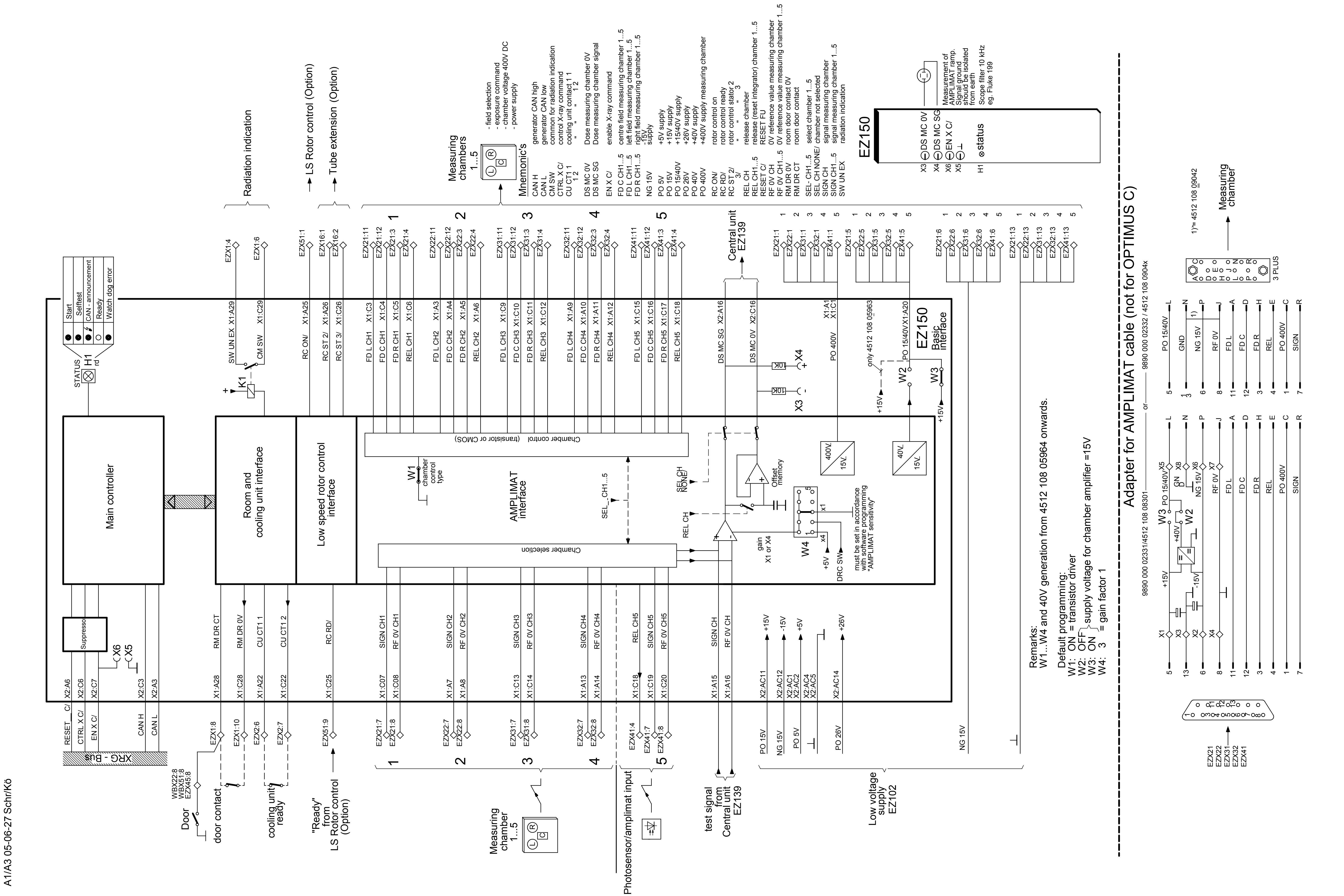
field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)

field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)

Chamber type and fields		chamber 12NC:						
Bucky Childrns. Chest Sco42/52	**Scopo 63/73 71/74**	**mAs measured**	**weigh-ting factor**	**anode position factor**	**nominal mAs (calcu-lated)**	**deviation mAs**	**% deviation**	**max % deviation**
center			**1**	**1**	**---**	**---**	**---**	**---**
left	additional							
right	lateral							

field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)

field
mAs - (mAs x x)
-- x 100% = %
(mAs x x)



Basic interface

Z1-6

4512 983 05531

CSIP Level 0 (05.0)